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THE ROLE OF FOREST INSECTS IN THE OPERATION
OF SUSTAINED-YIELD FOREST MANAGEMENT

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Mr. Chairman, members of the Pacific Slope Branch of the American Association of Economic Entomologists:

This is the first meeting of your association which I have had the privilege of attending. However, by reason of having had to deal rather intensively with entomological problems as they pertain to forestry during the last ten years, during which period I have enjoyed the acquaintanceship and assistance of a number of your members, I feel rather at home in this gathering.

When the vice-chairman of this meeting contacted me relative to presenting a paper he suggested that it be on a subject which would focus attention on the important part which insects play in the successful practice of forestry. I have, therefore, chosen as my topic "The Role of Forest Insects in the Successful Operation of Sustained-Yield Forest Management". Someone has said that forestry is 90 percent protection. We foresters like to think that the end result of growing successive crops of usable timber products is due, in a substantial measure at least, to the application of technical practices in respect to silviculture and management. There can be no question, however, that without protection of our virgin, second growth or even seedling stands of trees, technical practices would avail us nothing.

To the layman protection of our forest resources brings immediately to mind the prevention and suppression of forest fires. Many, perhaps most people, are not aware that to the forester charged with the responsibility of making our timber resources contribute to the utmost in community stability through sustained-yield management, fire is only one of the enemies from which the forest must be protected - protection of our timber stands from disease and particularly from the depredations of forest tree-destroying insects in many instances constitutes a more important and complex problem in management than is caused by the more spectacular forest fire.

According to the U. S. Department of Agriculture report entitled "A National Plan for American Forestry" transmitted to the Senate on March 30, 1933 in response to Senate Resolution 175, actual surveys in our western forest areas indicate from 5 to 6 billion board feet of timber products are destroyed annually due to the activities of the various bark beetles, principally those of the genus Dendroctonus. In stumpage value this may amount to from 12 to 15 million dollars annually - in terms of needed manufactured products, in labor and in community stabilization the loss is many times greater.

Insects that injure or kill forest trees are always present in mature timber stands. Under normal conditions they are held in check by their many natural enemies and the unfavorable factors of their environment. This normal condition is by no means stable and at times certain insect species may find conditions favorable for rapid increase in numbers, which may result in the killing of a large percentage of forest trees over large areas. Such epidemic conditions may last for only a year or two and then quickly subside naturally or they may continue over considerable periods even though combatted by man as well as their natural enemies. The devastating infestations of the Black Hills beetle in the ponderosa pine stands of South Dakota from 1895 to 1908; the mountain pine beetle epidemic in the lodgepole pine stands of Montana, Idaho and western Wyoming from 1927 to 1932; and the normally short-lived spruce budworm infestation in the Douglas fir stands on the Shoshone Forest from 1930 to 1939, are illustrations.

The degree to which the estimated monetary loss due to insect depredations is subject to probability of error is dependent upon the interpretation of values and the applicability to the entire country of the actual examples that were studied by the estimator. To the forester the importance or value of such losses may be measured if we refer only to the loss of increment, through the actual killing or retarding the growth of trees making up the stand. Foresters are, however, also concerned with other values inherent in the forest which are less easily measured, such as those for watershed protection and public recreational purposes. It is to the more readily determined values that further discussion will be confined.

Insect outbreaks of epidemic proportions occurring from time to time definitely deplete the forest capital to such an extent that long periods are required for replacement. Forest types composed chiefly of a single species are liable to have a high percentage of the trees destroyed. Such insect-killed trees are a further menace to adjacent stands as they constitute a greatly increased fire hazard after a few years.

The loss may not be as complete as on areas devastated by fire, but the effect on the reduction in the allowable cut from a working circle or other unit may be just as serious. For example, only 30 or 40 percent of the merchantable volume of a given unit may be actually killed by bugs, but this may reduce the volume and value of the remaining timber to the point that a logging operation is economically impracticable. Thus, timber perhaps equal to or greater in value than that actually killed may be rendered useless in calculating the allowable annual cut on a sustained yield basis, as far as the first cutting cycle is concerned.

I am going to mention several concrete examples of the role forest insects have played or may play in management of the timber resources of the Intermountain Region on a sustained yield basis.

About 20 years ago a management plan was prepared for a working circle on one of our more important timber forests. This plan indicated that a sizable

volume of timber could be cut indefinitely, and on the strength of this a central milling plant of moderate capacity was established. Subsequently an infestation of the western pine beetle caused a loss in the most valuable tree species of the working circle estimated to be from 20 to 25 percent of the original volume. This was one of the important contributing factors as to why we are today going far beyond the boundaries of the original working circle to supply raw material to the established plant and why in spite of this the prospects for sustaining the operation until a second cut can be made are extremely poor. The closing down of the central plant will not result in a ghost town so prevalent in some parts of the country but will nevertheless be a serious blow to the little community in which it is located.

We have another working circle which will support a relatively small cut of good quality timber on a sustained basis. The demand for timber products within this circle is good and the cut could probably be materially increased. Considerable merchantable volume has been lost during the last few years from the depredations of the Douglas fir bark beetle. Here the forester is faced with the problem of whether it is more in the public interest to permit and even encourage material overcutting in order to "beat the bugs to it", which would result in a material hiatus in a sustained yield operation, or to confine the annual cut to the calculated sustained figure, or even reduce it, in the expectation that the infestation will shortly run its course and naturally subside. In this particular working circle the estimated loss in merchantable volume in 1939 was nearly equal to the allowable annual cut.

For an entire forest in northern Utah the calculated allowable annual cut is only about 5-1/2 million board feet. Timber from this forest is much in demand and is of great importance to the dependent local residents and communities. An insect epidemic comparable to that which occurred on this forest in 1929-1932 might make it necessary to reduce this already small cut to the point that construction and maintenance of improvements on surrounding farms and small communities would be seriously affected.

Perhaps some of you are wondering what we foresters can do or have done in solving the insect problem.

It is obviously better to prevent destructive outbreaks of forest insects than to wait until they have gained such momentum as to make direct control necessary. This objective will, we hope, be attained more fully in the future through the application of more refined silvicultural practices to our timber stands whereby unfavorable conditions for the development of insects are maintained or greater resistance of the stand to insect attack is developed. Studies by one of your members has shown a definite relationship between the age and vigor of ponderosa pine and its ability to resist successful insect attacks under normal endemic conditions. Foresters have put these data to practical application by devising marking rules which provide for the rapid removal of the higher risk trees for cutting 25 to 30 years hence - trees which a few years ago would have been cut in the initial operation. Thus stands are being put in a condition unfavorable to the development of insect epidemics in the shortest practicable time. Application of this same general principle has been extended to other species such as

lodgepole pine and Douglas fir both of which are particularly susceptible to the attacks of bark beetles. Growing timber crops on a shorter rotation; better clean-up of accumulations of slash favorable for a build-up of the bark beetle population; and limiting thinning operations in the younger stands to those seasons where the danger of excessive loss from the genus Ips is materially lessened are other tools which the forester can and does use as a means of reducing insect loss.

While progress has been made it will take many years to put our virgin stands in good growing condition, and insect epidemics will have to be met when and where they occur by direct control methods.

You may be interested in knowing the amount of direct control which has been done in the Intermountain Region, comprising all of the national forests in Utah; those in Wyoming west of the Continental Divide; those in Idaho south of the Salmon River and those in Nevada east of the Sierras.

Intensive control work started in 1927 and reached its first peak about 1931 when strenuous efforts were made to halt the so-called Yellowstone infestation on its eastward march. Except for some project work on the Minidoka there was a comparative lull in insect activity until 1939, which was the start of the present peak in which we now find ourselves. From 1927 up to and including 1941, a total of nearly 460,000 trees, chiefly lodgepole pine infested with the mountain pine beetle, have been treated in our control operations. A combination of treating methods have been used, including the standing-burning method, in which the standing infested tree is sprayed with fuel oil to the height of the infestation and burned; the felling-decking-burning method in which the trees are felled, the infested portions decked or piled and burned; and during the last two years the spraying method developed by the Bureau of Entomology and Plant Quarantine, in which the infested portion of the tree is sprayed with a solution consisting of four parts fuel oil and one part orthodichlorobenzene.

The standing-burning and the spraying methods can be used only on thin-barked tree species such as lodgepole, white bark and limber pine. In treating thick-barked species such as ponderosa pine and Douglas fir, the felling-decking-burning method must be used. Peeling is resorted to only in exceptional cases on account of the higher cost.

In using the standing-burning method, and to a lesser extent the felling-decking-burning method, the danger of fires getting out of control is always present during late spring and early summer operations and added expensive fire precautions must be taken. On the other hand, the spraying method is most effective during hot dry weather and its adoption permitted us last season to continue control operations with safety and effectiveness up until about July 20. We, in this Region, regard this method of control highly. Its extensive application during the next few years is extremely doubtful however, due to the diversion of the "ortho" into the basic war effort.

During the last three years our control operations have been centered on the Powell and Dixie Forests in southern Utah where an epidemic of the Black Hills beetle in ponderosa pine has been brought under control; and on the Ashley and Wasatch Forests where we have a serious infestation of the mountain pine beetle in lodgepole pine. The epidemic on the Ashley has been controlled, as has that occurring on several units of the Wasatch. At least one more season's work remains to be done on the latter forest, however.

Our picture of the forest insect situation, past and present, in the Intermountain Region would not be complete without acknowledgment of the excellent cooperation in the form of practical assistance and technical advice which has been given us by the personnel of the Bureau of Entomology and Plant Quarantine.

I hope that in this paper I have been able to show that forest insects do play a very important role in the successful operation of sustained-yield forest management.